

What is claimed is:

1. A process for hydrocyanating 1,3-butadiene over at least one nickel(0) complex having phosphorus ligands as a catalyst, which comprises using the 1,3-butadiene in a mixture with n-butane of from 60 to 90% by volume of 1,3-butadiene and from 40 to 10% by volume of n-butane and preparing it by the following process steps:
 - A) providing a feed gas stream a comprising n-butane;
 - B) feeding the feed gas stream a comprising n-butane into at least one first dehydrogenation zone and nonoxidatively catalytically dehydrogenating n-butane to obtain a product gas stream b comprising n-butane, 1-butene, 2-butene, 1,3-butadiene, steam, low-boiling secondary constituents and in some cases steam;
 - C) feeding the product gas stream b of the nonoxidative catalytic dehydrogenation and an oxygenous gas into at least one second dehydrogenation zone and oxidatively dehydrogenating 1-butene and 2-butene to obtain a product gas stream c comprising n-butane, 2-butene, 1,3-butadiene, hydrogen, low-boiling secondary constituents and steam, said product gas stream c having a higher content of 1,3-butadiene than the product gas stream b;
 - D) removing steam, low-boiling secondary constituents and steam to obtain a C₄ product gas stream d substantially consisting of n-butane, 2-butene and 1,3-butadiene;
 - E) feeding the C₄ product gas stream d into a distillation zone and removing a 1,3-butadiene/n-butane mixture as a product of value stream e.
2. The process according to claim 1, wherein the nonoxidative catalytic dehydrogenation of n-butane is carried out autothermally.
3. The process according to claim 1 or 2, wherein the feed gas stream comprising n-butane is obtained from liquefied petroleum gas (LPG).
4. The process according to any of claims 1 to 3, wherein the nickel(0) catalyst comprises phosphorus ligands which are selected from the group consisting of

mono- or bidentate phosphines, phosphites, phosphinites, phosphonites and phosphinite phosphonites.